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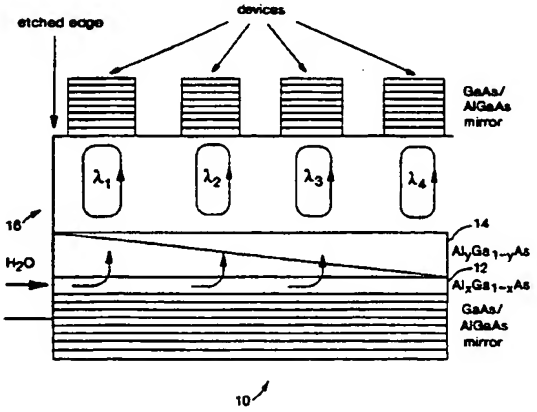
(54) Title: POSTGROWTH ADJUSTMENT OF CAVITY SPECTRUM FOR SEMICONDUCTOR LASERS AND DETECTORS



(57) Abstract: A method for selectively tuning the wavelength of optical cavities in semiconductor lasers and detectors after epitaxial growth using lateral wet oxidation. Tuning layers of $Al_xGa_{1-x}As$ and $Al_yGa_{1-y}As$ are positioned inside or adjacent to the optical cavity. Wet lateral oxidation is then used to transform the high-index semiconductor into a low-index oxide for tuning. The oxidation proceeds laterally into the $Al_xGa_{1-x}As$ and then attacks the $Al_yGa_{1-y}As$ layer vertically. The ratios of the oxidation rates can be controlled by adjusting the compositions of the materials, most notably because the oxidation rate increases as the amount of aluminum increases. The oxidized thickness depends on the time that the tuning layer is exposed to vertical oxidation. Due to the change in optical index from the semiconductor to the oxide, the optical thickness and the resonant wavelength of the cavity are also tailored along the lateral oxidation. As a result, the resonant wavelength of a device depends on its distance from the etched edge.

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INTERNATIONAL SEARCH REPORT

Interr ıal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01S5/40 H01S5/183 H01L31/0232 H01L33/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H01S H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, INSPEC, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FIORE A ET AL: "POSTGROWTH TUNING OF SEMICONDUCTOR VERTICAL CAVITIES FOR MULTIPLE-WAVELENGTH LASER ARRAYS" IEEE JOURNAL OF QUANTUM ELECTRONICS,IEEE INC. NEW YORK,US, vol. 35, no. 4, April 1999 (1999-04), pages 616-622, XP000850971 ISSN: 0018-9197	1-13, 16-24, 26-46
Y	the whole document	3,14
A		15,25

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[X] Further documents are listed in the continuation of box C. [ ] Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

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Date of the actual completion of the international search	Date of mailing of the international search report
17 October 2000	03/11/2000

Name and mailing address of the ISA	Authorized officer
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Interr nal Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	WIPIEJEWSKI T ET AL: "VERTICAL-CAVITY SURFACE-EMITTING LASER DIODES WITH POST-GROWTH WAVELENGTH ADJUSTMENT" IEEE PHOTONICS TECHNOLOGY LETTERS,US,IEEE INC. NEW YORK, vol. 7, no. 7, 1 July 1995 (1995-07-01), pages 727-729, XP000516835 ISSN: 1041-1135	6,7,9, 26,43
Y	the whole document	14

X	CHANG-HASNAIN C: "VERTICAL-CAVITY SURFACE-EMITTING LASERS:2-D ARRAYS" PROCEEDINGS OF THE OPTICAL FIBER COMMUNICATION CONFERENCE,US,NEW YORK, IEEE, vol. CONF. 15, 2 February 1992 (1992-02-02), page 100 XP000341618 ISBN: 1-55752-222-7	6,7,9,26
Y	the whole document	3

A	FIORE A ET AL: "LOW-THRESHOLD MULTIPLE-WAVELENGTH VERTICAL-CAVITY LASER ARRAYS OBTAINED BY POSTGROWTH WET OXIDATION" ELECTRONICS LETTERS,GB,IEE STEVENAGE, vol. 34, no. 19, 17 September 1998 (1998-09-17), pages 1857-1858, XP000853427 ISSN: 0013-5194 the whole document	1-46

X	FIORE A ET AL: "Postgrowth tuning of cavity resonance for multiple-wavelength laser and detector arrays" TECHNICAL DIGEST. SUMMARIES OF PAPERS PRESENTED AT THE CONFERENCE ON LASERS AND ELECTRO-OPTICS. CONFERENCE EDITION. 1998 TECHNICAL DIGEST SERIES, VOL.6 (IEEE CAT. NO.98CH36178), TECHNICAL DIGEST SUMMARIES OF PAPERS PRESENTED AT THE CONFERENCE ON LASE, pages 467-468, XP002150211 1998, Washington, DC, USA, Opt. Soc. America, USA ISBN: 1-55752-339-0 the whole document	1,3,6,7, 9,26,43

A	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 09, 30 September 1997 (1997-09-30) & JP 09 135051 A (NEC CORP), 20 May 1997 (1997-05-20) abstract	1-46

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INTERNATIONAL SEARCH REPORT

...formation on patent family members

Interr ...al Application No
PCT/US 00/11048

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 09135051 A	20-05-1997	JP 2806333 B	30-09-1998